6C

Estimating a Water Management Option's Unit Cost

A key consideration in the options evaluation process is the appraisal of costs, both financial and economic. Financial costs are the expenditures required to repay debt (with interest) incurred to finance capital costs of a project and to meet operations, maintenance, and replacement costs. Generally, financial costs are spread over a shorter time period than the life of the project. In comparison, economic costs reflect the costs of resources committed to the construction and operation of a project over its life, which can be 50 years or more for many water resources options. It is possible for options to be economically feasible and financially infeasible, or vice versa.

This appendix focuses upon economic costs. Although economic costs can be expressed in many different ways, a useful statistic is the economic cost per acre-foot of option delivery. The mathematical computation of unit cost is not difficult, but does entail several considerations.

Considerations Common to All Options

Data Availability

Cost estimates require extensive data on an option's costs and its operation under different hydrologic conditions. Costs include capital and annual operations, maintenance, and replacement costs. Capital costs are associated with construction and implementation of an option (including transportation and treatment facilities). Examples of capital costs include expenditures for planning, design, right-of-way, construction, and environmental mitigation. Capital costs also include activation costs (operation and maintenance expenditures prior to operations) and reservoir filling costs. OM&R costs include administration, energy, water purchases, water treatment, and replacement costs incurred during the normal course of project use.

For many options (such as surface water reservoirs and groundwater/conjunctive use projects), hydrology is key to evaluating the option's performance. Some options are designed to provide maximum deliveries during average and wet years and minimal deliveries during drought years; others are designed to provide maximum deliveries during drought years with minimal deliveries during other years. Some options can provide a relatively constant supply regardless of water year type.

Because this Bulletin focuses on local options, cost estimates are dependent upon cost and hydrology data available in existing reports and other documents prepared by water agencies. Some difficulties that arise in using this information include:

- Data are inconsistent among the agencies (different hydrologic time periods were used).
- Data are missing or incomplete (sometimes capital costs are reported, but not operating costs).
- Data may be available, but information about assumptions used in their development is not available (reported total capital costs may or may not include environmental mitigation costs).
- Data were developed at different times (information on some options is relatively new, while other data may be 30 years old).
- Data were developed at different levels of study (appraisal level data are being compared to feasibility level data).

Since the Bulletin's intent is to examine options

from a statewide perspective at an appraisal level of detail, the approach used has been to acknowledge that these difficulties exist, but to use the available information. The scope of this Bulletin does not permit development of new information for all of the options for which data were collected. The Bulletin's efforts focused on making costs of the statewide options and larger local options comparable, where possible.

Assumptions

Two analysis periods were used—a 50-year period for capital-intensive options (reservoirs, desalting plants, conjunctive use facilities) and a 25-year period for less capital-intensive options (demand reduction).

The analysis used constant dollars, thus excluding price changes occurring as a result of inflation. The time value of money is represented by a 6 percent discount rate. Dollar values are converted to constant 1995 dollars using USBR's cost index or other cost indices as appropriate. Statewide probabilities for the occurrence of drought years and average years are 20 and 80 percent, respectively.

Method of Analysis

A spreadsheet was developed for cost computations. Table 6C-1 shows the results of a sample cost analysis for four hypothetical water management options using this spreadsheet.

Considerations Specific to Some Options

Conservation

In order to achieve savings from many demand reduction options (landscape retrofits, toilet retrofits), water users rather than water districts must purchase additional equipment. Because of the substantial user costs of some conservation options, they must be addressed in cost estimates. Since the Bulletin 160-98 options evaluation process is focused on costs from the water agency perspective, it is assumed that costs of demand reduction options are funded by water agencies, including reimbursements to water users for costs such as landscape replacement or sprinkler controller installation.

Water Recycling

Costs of water recycling vary with the intended use of the water, due to differences in treatment requirements. Costs of recycling projects are highly site-specific, since costs of associated conveyance and distribution systems may constitute a large percent of the total project cost.

Conjunctive Use Projects

Because conjunctive use projects often involve many types of facilities and are operated according to changes in hydrology, computing cost estimates can be complex. Hydrology is key to the operation of many conjunctive use projects because usually the recharge portion of the project is operated in average years and the extraction portion is operated in drought years. Facilities may not be operated during years where there is insufficient water for recharge, or when conditions are too wet to warrant extractions. Although capital costs of a conjunctive use project are not significantly influenced by hydrology, annual O&M costs are sensitive to hydrology because of pumping costs.

Surface Water Reservoirs

Some reservoirs are operated to maximize water supplies during average years and others are operated

TABLE 6C-1

Sample Cost Computation

Option	*Option Delivery (taf)*		*Probabilities (%)*		*Capital Costs*	*Annual Variable Costs (Million$)*		*Unit Cost ($/af)*
	Average	*Drought*	*Average*	*Drought*	*(Million $)*	*Average*	*Drought*	
Groundwater Recharge/ Conjunctive Use	0	15	80.0	20.0	4.0	0.1	0.6	150
Water Transfers[a]	0	2	80.0	20.0	0.0	0.0	0.5	250
Water Recycling	3	3	80.0	20.0	24.0	0.6	0.6	710
Surface Water Reservoir	10	3	80.0	20.0	80.0	1.0	2.0	730

[a] Using existing facilities.

for drought years or emergency storage purposes. Although the capital cost to construct a reservoir will be the same regardless of its operation, the cost of water supply will differ substantially among these operational modes. A reservoir's O&M costs will vary significantly depending upon whether it provides on-stream or off-stream storage (the latter operation will likely have substantial energy costs associated with reservoir filling). Of supply augmentation options, reservoirs are most likely to provide substantial benefits other than water supply, such as recreation, flood control, and power generation. No attempt is made in this Bulletin to allocate the costs among different purposes, because cost allocation goes beyond the Bulletin's appraisal-level scope of analysis.

Water Marketing

Water transfer costs shown in the Bulletin are generally those reported by local agencies for their proposed marketing arrangements. Costs reported by local agencies are often the contractual prices contained in transfer agreements. Such costs usually do not include environmental mitigation costs or costs relating to third-party impacts.